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METHODS OF POULTRY MANAGEMENT AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 20, 1909.

SIR: I have the honor to transmit herewith a manuscript entitled "Methods of Poultry Management at the Maine Agricultural Experiment Station," which is mainly a compilation and revision of material contained in Bulletin 90 of this Bureau and in various bulletins of the Maine station, the authors of which were Dr. Charles D. Woods and the late Prof. Gilbert M. Gowell. In addition there are included descriptions of such new and improved methods and appliances as have been put into practice since those bulletins were issued. The work of compilation and revision has been done by Dr. Raymond Pearl, Expert in Poultry Breeding of this Bureau and Biologist of the Maine Station. Credit for originating the methods and practices described, with a few exceptions, belongs to Professor Gowell.

Poultry investigations have been a special feature at the Maine station for many years, and the results of the experimental and practical work have been of much value to poultrymen throughout the country. Since 1904 the work has been carried on by cooperation between the station and this Bureau. As there has been a very large demand for information as to the methods of poultry management employed at the Maine station, and as the publications mentioned are no longer available, the present paper has been prepared and is respectfully recommended for publication as a Farmers' Bulletin.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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INTRODUCTION.

Many years' practical experience in raising and keeping poultry and investigations in poultry breeding at the Maine Experiment Station have resulted in the accumulation of a considerable fund of information on poultry management. It is the purpose of the following pages to outline this experience for the benefit of poultry keepers and thereby to help them to discriminate between some of the wrong theories which have underlain much of the common practice of the past and the better theories which underlie other and newer methods that are now yielding more satisfactory results. It may be that these methods are no better than those practiced by others, but the attempt is made to state concisely the methods which have been or are now being successfully employed at the station.

THE SELECTION OF BREEDING STOCK.

There are two or three much-advertised methods of judging a hen's productiveness from certain signs and marks, the secret of which will be disclosed by the inventor for a monetary consideration. The Maine station has not invested in nor investigated any of these methods. There may be ways to prophesy accurately what a hen will do in the way of egg production, but they have not come to the writer's attention.

EARLY LAYING A VALUABLE INDICATION.

The only absolutely sure way of making selection for breeding stock is by means of the data obtained from the use of trap nests. Only investigators and an occasional poultryman, however, can afford the equipment and the expense involved in operating trap nests, but every poultryman can, by closely observing his young stock during the autumn, select the pullets that are commencing or preparing to lay, and secure for the next season's breeding a pen of birds that have the function of egg production so strongly developed that they give evidence of it by its early exercise.

As evidence of the value of early-laying pullets, attention is called to the work performed by 29 April-hatched pullets that were selected from among their sisters out on the range in August and September, when they showed that they were laying or about to begin laying. They were not selected because of form or type as indicating egg production, but they were either just picked up as they were found on the nests or taken because their combs were red or because they tagged the attendant around and prated in the everyday hen language about the work they were soon going to do. They were carried to the laying house, marked with bands, and given access to trap nests.

Four of the 29 died within the year. The smallest layer of the remaining 25 laid 137 eggs the first laying year; 18 laid more than 160 eggs; and 8 laid over 200 eggs, and the average of the flock for the twelve months ending August 30, 1905, was 180 eggs. This average was much higher than that of all the pullets carried that year, and the flock contained no poor layers, but a phenomenal number of high layers. The high average of the flock and the large proportion of good layers point out the advantages of this method of selection when the use of trap nests, or other equally reliable methods of selection, is not practicable.

Poultrymen are generally desirous of securing as many well-bred pullets as possible, and so use 1-year-old hens as breeders in addition to their 2-year-olds. The work done by pullets from September to February or March is a pretty good indication of their usefulness, and their eggs are available for breeding during the pullet year. While the chickens from such eggs are not generally so large at maturity as those from older hens, they do not appear to lack constitution or vigor, and there is no apparent reason why they are not desirable for breeding purposes.

RAISING CHICKENS BY NATURAL PROCESSES.

While even the small grower of chickens in many cases uses an incubator for hatching, circumstances sometimes make it necessary to hatch and raise chickens by aid of the mother hen. To persons so situated an outline of the method practiced at the station before incubators had reached their present development may be helpful. An unused tie-up in a barn was taken for the incubating room and a platform was made along the inner side. The platform was 3 feet above the floor and was 2½ feet wide and 50 feet long. It was divided into fifty little stalls or nests, each 1 foot wide, 2 feet long, and 1 foot high. This left a 6-inch walk along the front of the nests for the hens to light on when flying up from the floor. Each nest had a door made of laths at the front, so as to give ventilation. The door was hinged

at the bottom and turned outward. Across the center of each nest a low partition was placed, so that the nesting material would be kept in the back end—the nest proper. For early spring work paper was put in the bottom of the nest, then an inch or two of dry earth, and on that the nest, made of soft hay.

Whenever half a dozen hens became broody they were taken in from the henhouse and put on the nests, each nest having a dummy egg in it; the covers were then shut up, and nearly every hen seemed contented. In a day or two 13 eggs were placed under each hen. Every morning the hens were liberated as soon as it was light, when they would come down of their own accord and burrow in the dry dust on the floor, eat, drink, and exercise, and in twelve or fifteen minutes they would nearly all go onto the nests voluntarily. In the afternoons one would occasionally be found off the eggs looking out through the slatted door. If she persisted in coming off she was exchanged for a better sitter. The double nest is necessary, otherwise the discontented hen would have no room to stand up, except on her nest full of eggs, and she would very likely ruin them. There was no danger of this with the double nest, as she would step off the nest, go to the door and try to get out.

The advantages of a closed room in which to confine the sitters are many, as the hens are easily controlled and do not need watching as they do when selecting nests for themselves, or when sitting in the same room with laying hens. A room 12 feet square could be arranged so as easily to accommodate 50 sitters.

The most satisfactory arrangement used at the Maine station for the accommodation of the hen with her brood of young chicks consisted of a closed coop about 30 inches square, with a hinged roof and a movable floor in two parts, which would be lifted out each day for cleaning. This little coop had a wire-covered yard attached to it on the south side. The yard was 4 by 5 feet in size and 1½ feet high. Its frame was of 1-inch by 3-inch strips and was fastened securely to the coop.

The wire on the sides was of 1-inch mesh, but on top 2-inch mesh was sufficient. Such a coop is easily kept clean, and the coop and yard can be set over onto clean grass by one person.

The small run will be sufficient for the first few weeks, but soon the chicks need greater range, and then the fence at the farther end of the run can be lifted up 3 or 4 inches and they can pass in and out at will, while the mother will be secure at home and they will know where to find her when they get cold or damp or need brooding. Such a coop accommodates 15 to 20 chicks until they no longer require brooding, after which several flocks should be combined in one and put in a portable house on a grassy range.

Whenever the hen is allowed to hatch or to mother chicks, much care must be exercised to prevent lice from getting a foothold and ruining the birds. The free and frequent use of fresh insect powder upon the hen, working it through the feathers to the skin, is one of the best methods for destroying the pests. Grease or oil is effective when applied to the heads and under the wings of young chicks, but care must be taken not to get too much on them, especially during damp weather. The feeding of chicks raised in coops with their mothers does not vary much from the feeding of those raised in brooders as described on page 11.

RAISING CHICKENS BY ARTIFICIAL PROCESSES.

Incubators have been so much improved that there are several kinds on the market that will hatch as many chicks from a given lot of eggs as can be done by selected broody hens. They require little care, maintain an even temperature, and are easily adjusted to meet the increase in temperature arising from the developments going on in the eggs. In some machines the moisture supply is automatic and adapted to the requirements; in others it has to be supplied, and skill is necessary in determining the quantity needed. The economy of the incubator is very great. A 360-egg machine will do the work of nearly 30 broody hens, and can be kept at work continually if desired.

THE INCUBATOR.

There are many makes of incubators on the market, most of which will give fairly satisfactory results. The Maine station has not tested many makes of incubators, and very likely some of the makes not tested would prove as satisfactory as the make used. Where many machines are used the hand turning of the eggs absorbs considerable time. Several turning devices are in vogue and equally good hatches have been obtained with them as when the eggs have been turned by hand. Machines that have artificial turning shelves will not hold quite as many eggs as when flat shelves are used, but the saving of time compensates for this.[a]

Whatever make of incubator is used, pains should be taken to become thoroughly acquainted with the machine before the eggs are put into it. It is advisable for a person not familiar with the use of an incubator to run the machine empty for several days before filling it. After the eggs are put in, changes and adjustments should

[a] A complete and useful discussion of the different types of incubators and the methods of managing them to get the best results is given in Farmers' Bulletin 236, "Incubation and Incubators," which may be obtained free on application to the Secretary of Agriculture, Washington, D. C.

be made with the greatest care for fear of extreme results. By the use of an incubator it is possible to determine exactly the time when the chickens shall be hatched. With the strain of Barred Plymouth Rocks bred by the Maine station it was formerly necessary to hatch the chickens in March in order to have them ready for November laying. By better methods of feeding, breeding, and treatment, it is now possible to delay the hatching until April and the first of May and have the pullets in good laying condition the last of October and early in November. Chickens hatched in March under the present method of breeding and feeding would in some cases begin laying in August.

THE INCUBATOR ROOM.

It is important that the incubator room be so situated that it can be kept at a fairly constant temperature. On this account an underground room is usually selected. For many years the well-lighted cellar under the wing of the farmhouse was used by the Maine station. A cold or badly ventilated cellar would, however, be poorly adapted for incubators. Ventilation is very important, and where several incubators are in use artificial ventilation must be provided, in order that the machines may be furnished with clean, fresh air at all times.

In 1905 the Maine station erected an incubator house which practically consists of a well-made, light, airy cellar with a house for the poultry man above it. The incubator room, which occupies the entire cellar, is 30 feet square. The room is 7 feet high in the clear, 5 feet of which is below the level of the outside ground. It is lighted by six 3-light windows, carrying glass 10 inches by 16 inches. The cement walls are finished smooth and the cement floor is slightly inclined toward the southeast corner where the intake of the drain is located. This enables the free use of water from hose in cleaning the room preparatory to starting the incubators. Two chimneys extend to the basement floor and contain ventilating flues that have no opening into the rooms above. Entrance to the room is through a covered outside cellar stairway leading into a shed at the rear of the building. The room now contains twelve 360-egg machines in addition to several of smaller capacity.

In the directions which accompany the hot-air incubators of the type used at the station it is stated that an artificial source of moisture is not needed in operating these incubators except in very arid parts of the country. It is said that in other places the normal moisture of the atmosphere is sufficient to insure the necessary moisture in the incubator. The experience of the station indicates that except in a rather wet season this is not the case. It has been found here that in an ordinary season if no artificial moisture is

supplied to the incubators there is too great an evaporation from the eggs. It is demonstrable that many eggs fail to hatch because of this dryness of the air in the incubator. It is not desirable here to enter into a detailed discussion regarding experiments on this point. It suffices to state the fact that in the station's experience better hatches have been obtained when moisture beyond that normal in the atmosphere is supplied during incubation. The most satisfactory way to supply this extra moisture has been found to be by wetting the cement floor of the incubator cellar thoroughly two or three times a day, depending on the degree to which evaporation is taking place. During the hatching season the aim is to keep the floor of the incubator cellar moist at all times.

BROODER HOUSES.

The poultry plant erected by the Maine station in 1897 included a permanent brooder house. The house was 14 feet wide by 60 feet long. Its front wall was 4 feet 10 inches high from the bottom of the sill to the top of the plate, and the back was 7 feet high. The ridge was 4 feet from the back side and 1 foot 6 inches higher than the back plate. This gave the short part of the roof back of the ridge and the long part to the front of it. The frame of the building was of 2 by 4's; it was boarded on the outside with hemlock boards, covered with paper, and shingled all over, and the building was ceiled on the inside with matched pine. This gave a 4-inch dead-air space in the walls and roof. The house also had a tight double floor with paper between. The front wall was 3 feet 8 inches high inside and the back wall 5 feet 9 inches from floor to ceiling. There was a 3½-foot door in each end; there were ten windows in the front wall, equal distances apart and 8 inches from the floor, and five windows in the back wall close up to the plate. The windows had 6 panes each of 10 by 12 inch glass and were in two parts, so as to slide up and down and admit fresh air and to keep the house cool in warm weather. The windows were all double. There were ten small doors, each 10 by 12 inches, placed close to the floor along the front wall, through which chickens could pass in and out; these doors were also double. Two galvanized iron ventilators at the top extended from the inside of the room up through the ridge and furnished sufficient ventilation during cold weather. The ventilators were regulated by means of a shut off at the ceiling.

The house was divided into ten breeding pens, each 6 feet by 10 feet 8 inches. The partitions between the pens consisted of an 8-inch board at the bottom with 3 feet of 1-inch-mesh wire above. A walk 2½ feet wide extended along the back of the building. The doors which led from the walk to the pens were made to swing both ways

and were covered with wire. A brooder was placed in each pen with a lamp door opening into the walk. Each of these pens accommodated about 60 chicks in winter, or 75 in spring when they could get out into the yards. The building, being low posted, was kept warm enough in winter by the ten brooder stoves, and the temperature under the hovers was usually found in the morning about the same as it was left the night before.

This house proved to be thoroughly satisfactory, but was burned in the spring of 1897 and has not been replaced. A permanent brooder house would be indispensable for the raising of winter chickens, and a house piped for hot water would have some advantages over the one here described. The advantages are especially great when raising chickens if April or May prove to be cold or wet, for then the

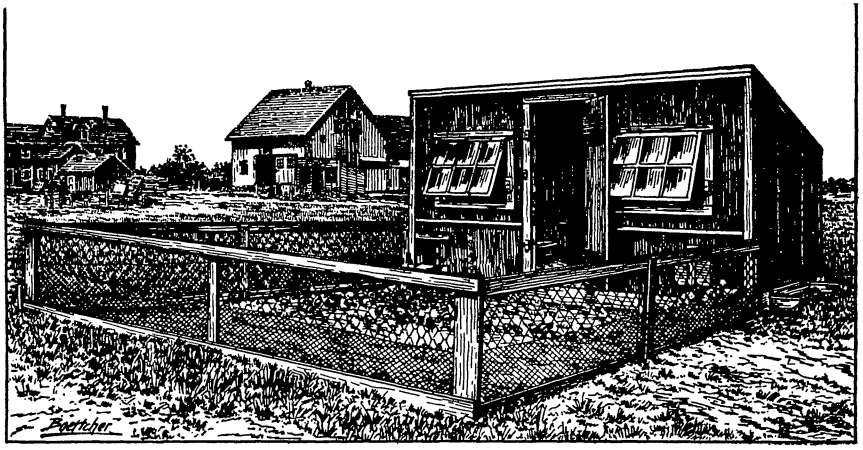

FIG. 1.—Portable brooder house.

small houses are apt to be cold outside of the brooders. In ordinary seasons, even in Maine, little or no difficulty is experienced in raising chicks hatched in April and May in the small houses. The expenditure would be greater for the piped house, for the reason that colony houses should be provided in which the chickens may be sheltered after they leave the brooder house.

Since the burning of the house just described, the Maine station has used small portable brooder houses (see fig. 1). The small brooder houses built on runners are readily moved about, and for the work with spring-hatched chickens are preferred to the large permanent brooder house. Several styles and sizes have been used, but the following meets the needs of the station better than any other that has been tried. The houses are built on two 16-foot pieces of 4 by 6 inch timber, which serve as runners. The ends of the timbers, which

project beyond the house, are chamfered on the underside to facilitate moving. The houses are 12 feet long; some of them are 6 feet and others 7 feet wide; 7 feet is the better width. They are 6 feet high in front and 4 feet high at the back. The frame is of 2 by 3 inch lumber; the floor is double boarded, and the building is boarded and covered with a good quality of heavy roofing paper. Formerly shingles were used for the outside covering, but paper is preferred and is now used exclusively. This kind of covering for the wall is not so likely to be injured in moving as shingles. A door 2 feet wide is in the center of the front and a 6-light window, hinged at the top, is on each side of it. Two brooders are placed in each of these houses and 50 to 60 chicks are put with each brooder. A low partition separates the flocks while they are young, but later it has to be made higher. The houses are large enough so that a person can go in and do the work comfortably, and each one accommodates 100 chicks until the cockerels are large enough to be removed. One of these houses is shown in figure 1.

An improvement has recently been made in these brooder houses by providing for better ventilation. When the weather is very hot there is no movement of air within one of these houses, even though the door and windows are open. The air within the house is practically stagnant and, on account of its relatively small volume, becomes intensely hot and stifling when the temperature outside gets high. The effect on the chicks under such circumstances is bad. They retreat to the houses to get shade, but only to be injured if not killed by the hot, stifling air of the house. To remedy this difficulty a slot 2 feet long and 1 foot wide has been cut in the back of each house high up under the eaves. This slot is closed with a wooden slide running in grooves which are put on the outside of the house. The opening is covered on the inside with 2-inch mesh chicken wire. On very hot days the slide is pulled out completely so as to expose the whole opening of the slot. At night or during a period of wet, cold weather the size of the opening is regulated to suit the conditions. It enables one to keep a current of fresh air through the house in the warmest weather. The effect on the well-being of the chicks during a period of hot weather is most marked and satisfactory.

Indoor brooders are used at the Maine station and are much preferred to any outside brooders the station has tried. The style used has the cover and part of one side arranged to turn down, making an inclining run the whole width of the brooder, up and down which the little chicks can go without crowding.

Most kinds of brooders as now made keep the chicks comfortable at desired temperatures and have good means of ventilation. The great difficulty lies in the lamps used. The lamp apartments are

small and the tendency is for the oil to become warm and form gases which cause the flame to stream up and make trouble. Most brooder lamps have water pans between the oil tank and the burner which tend to keep the oil cool, but even with this precaution the Maine station has had two fires, one of which was very serious. The brooders now in use have no water pans, but are so arranged that currents of cool air pass constantly over the oil tank and keep its contents cool. These lamps, or stoves, have been used for four years—last year more than 20 of them—and they are apparently safe.

TREATMENT OF YOUNG CHICKS.

When the chicks are 30 to 40 hours old they are carried in warm covered baskets to the brooders, and 50 or 60 are put under each hover, where the temperature is between 95° and 100° F. The temperature is not allowed to fall below 95° F. during the first week, or 90° F. during the second week; then it is gradually reduced according to the temperature outside, care being taken not to drive the chicks out by too much heat, or cause them to crowd together under the hover because they are cold. They should flatten out separately when young, and a little later lie with their heads just at the edge of the fringe of the hover. They should never be allowed to huddle outside of the brooder. They huddle because they are cold, and they should be put under the hover to get warm, until they learn to go there of their own accord. Neither should they be allowed to stay under the hover too much, but in the daytime should be forced out into the cooler air where they gain strength. They ought not to be allowed to get more than a foot from the hover during the first two days; then a little farther away each day, and down onto the house floor about the fourth or fifth day, if the weather is not too cold. They must not get cold enough to huddle or cry, but must come out from under the hover frequently.

The floor of the brooder is cleaned every day and kept well sprinkled with sharp, fine crushed rock, known in the market as "chicken grit." The floor of the house is covered with clover leaves or with hay chaff from the feeding floor in the cattle barns.

FEEDING YOUNG CHICKENS.

The best method of feeding young chicks is at present a matter of some uncertainty, and it is doubtful if there ever will be general agreement as to the one best method. One condition, however, appears to be imperative, and that is that the young things be not allowed to overeat. A number of different methods of feeding young chickens have been used at the station in the past. The most useful of these methods follow.

Method 1.—Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about six times their bulk of rolled oats, by rubbing both together. This mixture is the feed for two or three days, until the chicks have learned how to eat. It is fed with chick grit, on the brooder floor, on the short cut clover or chaff.

About the third day the chicks are fed a mixture of hard, fine-broken grains, as soon as they can see to eat in the morning. The mixture now used has the following composition:

	Parts by weight.
Cracked wheat	15
Pinhead oats (granulated oat meal)	10
Fine screened cracked corn	15
Fine cracked peas	3
Broken rice	2
Chick grit	5
Fine charcoal (chick size)	2

It is fed on the litter, care being taken to limit the quantity, so they shall be hungry at 9 o'clock a. m.

Several of the prepared, dry, commercial chick feeds may be substituted for the broken grains. They are satisfactory when made of good, clean, broken grains and seeds, but they contain no secret properties that make them more desirable than the home-mixed broken grains mentioned above. Their use is simply a matter of convenience. When only a few chicks are raised, it is generally more convenient, and probably not more expensive, to buy the prepared feed, but when many are raised it is less expensive to use the home-mixed feeds.

Sharp grit, fine charcoal, and clean water are always before the chicks. At 9 o'clock the rolled oats and egg mixture is fed in tin plates with low rims. After they have had the feed before them five minutes the dishes are removed and they have nothing to lunch on. At 12.30 o'clock the hard-grain mixture is fed again, as in the morning, and at 4.30 or 5 o'clock they are fed all they will eat in half an hour of the rolled oats and egg mixture.

When they are about 3 weeks old the rolled oats and egg mixture is gradually displaced by a mixture having the following composition:

	Parts by weight.
Wheat bran (clean)	2
Corn meal	4
Middlings, or "red dog" flour	2
Linseed meal	1
Screened beef scrap	2

This mixture is moistened with water just enough so that it is not sticky, but will crumble when a handful is squeezed and then

released. The birds are developed far enough by this time so that the tin plates are discarded for light troughs with low sides. Young chicks like the moist mash better than that not moistened, and will eat more of it in a short time. There is no danger from the free use of the properly made mash twice a day, and since it is already ground the young birds can eat and digest more of it than when the feed is all coarse. This is a very important fact, and should be taken advantage of at the time when the young chicks are most susceptible to rapid growth, but the development must be moderate during the first few weeks. The digestive organs must be kept in normal condition by the partial use of hard feed, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

By the time the chicks are 5 or 6 weeks old the small broken grains are discontinued and the two litter feeds are wholly of screened cracked corn and whole wheat. Only good clean wheat that is not sour or musty should be used.

When young chicks are fed as described, the results have always been satisfactory if the chicks have not been given too much of the scratch feed and if the dishes of ground material have been removed immediately after the meal was completed. The objections to this system of feeding are the extra labor involved in preparing the eggs, mixing the feed with water, and removing the troughs at the proper time.

Method 2.—This is like Method 1, except that fine beef scrap is used instead of boiled eggs and the mash is not moistened.

Early in the morning the chicks are given the hard feed on the floor litter as described in Method 1. At 9 o'clock they are fed a mixture having the following composition:

	Parts by weight.
Rolled oats	2
Wheat bran	2
Corn meal	2
Linseed meal	½
Screened beef scrap	1

This is given in the plates or troughs, and the dishes are removed after ten minutes' use.

At 12.30 the hard grains are fed again, and at 4.30 or 5 the dry-meal mixture is given to them for half an hour or left until their bedtime. The meal being dry, the chicks can not eat it as readily as they can the egg and rolled oats or the moistened mash. For that reason it is left for them to feed upon longer than when moistened with the egg and water, but is never left before them more than ten minutes at the 9-o'clock feeding time. The aim is to give them enough at each of the four meals so that their desire for food

may be satisfied at the time, but to make sure that they have nothing left to lunch upon. It is desired to have their crops empty of feed before feeding them again. When treated in this way they will have sharp appetites when the feeder appears, and come racing out from the brooder to meet him. If they have been overfed at the previous meal, and have lunched when they saw fit, they do not care for the feeder's coming. If overfed a few times the creatures become debilitated and worthless.

What has been said so far is with reference to chicks that are hatched out in early spring, at a season of the year when it is impossible under the climatic conditions in Maine for them to get out of doors for work.

Method 3.—This is like Method 2, except that the first mash for the young chicks has the following composition:

	Parts by weight.
Wheat bran	4
Corn meal	3½
Linseed meal	½
Screened beef scrap	2
Alfalfa meal	1

This mixture is scalded and then dry rolled oats are mixed with it in the proportion of 2 parts rolled oats to 6 parts of the mixture. The reason for mixing in this way is that it has been found by experience that if rolled oats are mixed with the other materials of the mash before scalding there is a tendency for the mash to be soggy after it is wet. Mixing in the way here outlined has been found to improve the mash greatly.

This mash and the dry grains are fed as in Method 2 until the chicks are about 3 weeks old. From 3 weeks on to 6 or 8 weeks the composition of the mash is as follows:

	Parts by weight.
Wheat bran	2
Corn meal	3
Linseed meal	½
Daisy flour	1
Beef scrap	1

Method 4.—When warm weather comes and the later-hatched chicks are able to get out on the ground they find much to amuse them, and they work hard and are able to eat and digest more feed. Under these conditions the dry-meal mixture described in Method 2 is kept constantly before them in troughs, with good results. With two feeds a day of the broken grains in the litter they have hard feed enough to insure health and they can safely peck away at the dry-meal mixture—a mouthful or two at a time—when they seem to happen to think of it, and thrive. This method has been considerably used in feeding April and May hatched chicks. Many times the results

from it have been good. At other times, when the weather was dark and raw out of doors and the little things were held inside, they would hang around the troughs and overeat. They would grow rapidly for a few days, then commence to go lame, eat little, and seek the warm hover never to recover.

Method 5.—This consists in feeding the cracked corn, cracked wheat, pin-head oats, and millet seed in the litter four times a day, and keeping a trough of fine beef scrap within reach all the time. Sometimes commercial chick feeds have been used instead of the cracked corn, wheat, oats, and millet. By this system the losses of birds have been small when the feeding has not been so liberal as to clog the appetite. Much care is necessary in adjusting the quantity of feed to the needs of the birds.

Other methods of feeding young chicks have been tried and the results watched. Method 1 has been used for several years and no other has been found that gives better growth or less losses of birds. The only objection to it is the labor required in preparing the feed. In the work of the station Method 3 is now preferred and used. The losses of chicks are small by either of the methods. The labor in Method 2 is considerably less than is required in Method 1. Where either Methods 1, 2, or 3 are used the liability of injury to the chicks is much less than when Methods 4 or 5 are followed.

There are no mysteries connected with the raising of the young chickens. Every chick that is well hatched out by the twenty-first day of incubation should live, and will do so as a rule if kept dry, at reasonable temperatures, and not allowed to overeat.

The most careful work of the poultryman during the whole year is required in getting the chicks through the first three weeks of their lives successfully. If they are vigorous up to the fourth week, there is little liability of injuring them thereafter by any system of feeding, if it is only generous enough and they have their liberty.

FEEDING CHICKENS ON THE RANGE.

By the middle of June the chickens that were hatched in April are being fed on cracked corn, wheat, and the mash. At about that time the portable houses containing the chickens are drawn from their winter locations out to an open hayfield where the crop has been harvested and the grass is short and green. If not too much worn, the same field may be used a second season for chickens, but this is not recommended. A new, clean piece of turf land should be used each year. Two acres should be allowed for each 1,000 chickens.

When the chickens are moved to the range, the sexes are separated. The methods of feeding the cockerels and pullets differ, and there has been a gradual change in the methods of feeding. Each method

has given good results. The changes have been introduced to save labor. After the chickens were moved to the range they were fed in the morning and evening with a moistened mixture of corn meal, middlings, and wheat bran, to which one-tenth as much beef scrap was added. The other two feeds were of wheat and cracked corn.

In 1904 a change was made in the manner of feeding 1,400 female chickens by omitting the moist mash and keeping in separate slatted troughs cracked corn, wheat, beef scrap, cracked bone, oyster shell, and grit where they could help themselves whenever they desired to do so. Grit, bone, oyster shell, and clean water were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

In 1905 another trough containing a dry mash consisting of 1 part wheat bran, 2 parts corn meal, 1 part middlings, and 1 part beef scrap was used in addition to those containing the grains. The results were satisfactory. The labor of feeding was far less than that required by any other method tried. The birds did not hang around the troughs and overeat, but helped themselves, a little at a time, and ranged off, hunting or playing, and coming back again to the food supply at the troughs when so inclined. There was no rushing or crowding about the attendant, as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap, they did not overeat of it. During the range season, from June to the close of October, the birds ate just about 1 pound of the scrap to 10 pounds of the cracked corn and wheat. This is practically the proportion eaten when the moist mash was used.

THE FEEDING TROUGH.

The difficulty of keeping the feed clean and dry during continued exposure is nearly overcome by using troughs with slatted sides and broad, detachable roofs (figs. 2 and 3). The troughs are from 6 to 10 feet long, with the sides 5 inches high. The lath slats are 2 inches apart, and the troughs are 16 inches high from floor to roof. The roofs project about 2 inches at the sides and effectually keep out the rain except when high winds prevail.

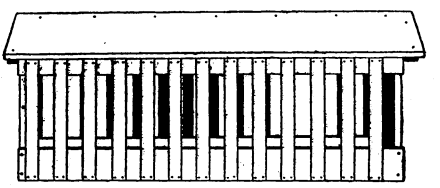

FIG. 2.—Chicken feeding trough, accessible from both sides, with cover on.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests, as shown in figure 3. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is economical of feed,

keeping it in good condition and avoiding waste. When dry mash is used there may be considerable waste by the finer parts being blown

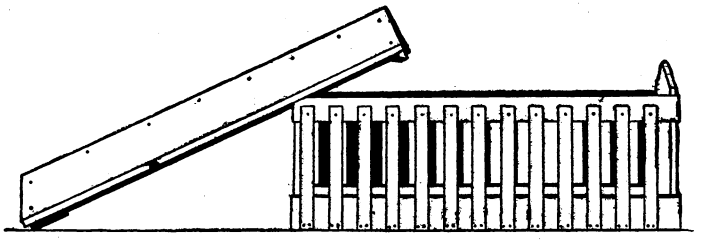

FIG. 3.—Chicken feeding trough with cover removed.

away, and on this account the dry-mash trough should be put in a sheltered place out of the reach of wind.

FEEDING THE COCKERELS FOR MARKET.

At the Maine station most of the cockerels are to be used for breeding purposes, and they are fed in flocks of about 100 on the range in about the same way as the pullets. The dry-feed method is now used for them as satisfactorily as for the pullets.

A very large proportion of the cockerels raised in New England are sent to the market alive, without being fattened. Quite extended experiments at the Maine station with many birds in different years indicate very clearly that keeping the cockerels for a few weeks with special feeding will add materially to the selling price. Not infrequently this will make the difference between loss from the low price obtained for slow-selling unfattened birds and the profit from comparatively quick-selling specially fed birds at a much higher price. The higher price is due partly to the increased weight and partly to the superior quality of the well-covered soft-fleshed chickens. As the bulletins containing the results of these feeding experiments with cockerels are out of print, the following brief summary of the results obtained is given:

The number of pounds of grain required to produce 1 pound of gain in fattening cockerels was ascertained in experiments comparing (1) the effect of housing, (2) the effect of age, and (3) the effect of skim milk. The grain mixture used in these series of experiments was the same, consisting of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of meat meal. This was fed as a porridge thick enough to drop but not to run from a spoon.

The French and English fatteners who make a specialty of the business, fattening thousands of chickens each year, confine the chickens in small coops. The coops used at the Maine station gave a floor space of 16 by 23 inches, in each of which 4 chickens were placed. The

coops were constructed of laths with closed-end partitions of boards. The floors, sides, and tops were of laths placed three-quarters of an inch apart. By simply moving the pens thus constructed the floors were kept clean. V-shaped troughs with 3-inch sides were placed in front and about 2 inches above the level of the floors of the coops. Cockerels thus fed were compared with others kept in small houses 9 by 11 feet in size, with an attached yard 20 feet square. The yard was entirely free from anything that would serve as green feed. Twenty birds were put in each of these houses. As a result of experiments with fattening 286 birds it was found that on the average 7.9 pounds of grain were required to produce 1 pound of gain in the case of birds fed in the coops, and 5.9 pounds in the case of those fed in the small houses and yards.

An experiment with 150 birds when they were 4 months old showed that they required 4.9 pounds of grain to produce 1 pound of gain, while birds from the same stock, when they were 6 months old, required 7.4 pounds of grain to produce 1 pound of gain.

An experiment with 68 birds showed that when the porridge was wet with skim milk only 4.3 pounds of grain were required to produce 1 pound of gain, against 5.3 pounds when the porridge was wet with water. Eight pounds of skim milk was used with each pound of grain.

These experiments warrant the following conclusions: (1) As great gains are made just as cheaply and more easily when the chickens are put into small houses and yards as when they are fed in small lots in lattice coops just large enough to hold them. (2) Four weeks is about the limit of profitable feeding, both individually and in flocks. (3) Chickens gain faster while young. Birds that are from 150 to 175 days old have uniformly given comparatively small gains. (4) The practice of successful poultrymen selling chickens at the earliest marketable age is well founded. The spring chicken sold at Thanksgiving time is an expensive product.

The experiments clearly indicate that it is profitable to fatten chickens in cheaply constructed sheds or in large coops with small runs for about four weeks and then send them to market dressed. In quality the well-covered, soft-fleshed chickens are so much superior to the same birds not specially prepared that the former will be sought for at a higher price. The dairy farmer is particularly well prepared to carry on this work, as he has the skim milk which these experiments show to be of so great importance in obtaining cheap rapid growth and superior quality of flesh.

HOUSING THE HENS.

When work in poultry management was first undertaken at the University of Maine, the hens were kept in small colonies in accord with what was at that time believed to be the best practice. Houses

10 feet square were erected with the idea of accommodating about 15 birds each. Although the houses were well warmed they were apt to be damp and lined with white frost in very cold weather, when the windows had to be kept shut to protect the birds from cold at night. Another disadvantage of this kind of house is its small size. A person can not care for hens in such small pens without getting them into a condition of unrest for fear of being cornered in such a small room. The question of extra labor in caring for hens in these small colonies scattered over quite a large area is an important factor in a commercial plant. When the Maine station began experiments in 1897 a warmed house 150 feet long by 16 feet wide was erected. As before mentioned, this house was burned the next spring, but was replaced by another of the same kind. This warmed house, while constructed after the most approved model of the time, has never been a satisfactory house for laying hens. In recent years it has been used only for the keeping of surplus stock and for carrying cockerels over the winter. It has now been abandoned entirely in favor of curtain-front houses to be described below.

THE ROOSTING-CLOSET HOUSE.

Seven years ago one of the 10-foot square houses described above was taken for a nucleus and an addition made, so that the reconstructed house was 10 feet wide and 25 feet long. The inside end of the old house was taken out, so that there is one room with a floor space of 250 square feet. The walls are about 5½ feet high in the clear inside of the building. The whole of the front wall is not filled in, but a space 3 feet wide and 15 feet long is left just under the plate. This space had a frame covered with white drilling, hinged at the top on the inside, so it can be let down and buttoned during driving storms and winter nights, but hung up out of the way at all other times. The cloth of the outer curtain is oiled with hot linseed oil. The roost platform extends the whole length of the back of the room. It is 3 feet 4 inches wide and 3 feet above the floor. The back wall and up the roof for 4 feet is lined and the space filled and packed hard with fine hay. The packing also extends part way across the ends of the room.

Two roosts are used, but they do not take the whole length of the platform, a space of 4 feet at one end being reserved for a crate where broody hens can be confined until the desire for sitting is overcome. The space, from the front edge of the platform up to the roof, is covered by frame curtains of drilling, similar to the one on the front wall, except that it is not oiled. They are hinged at the top edge and kept turned up out of the way during daytime, but from the commencement of cold weather until spring they are closed down every

night after the hens go to roost. The hens are shut in this close roosting closet and kept there during the night, and are released as early in the morning as they can see to scratch for the grain which is sprinkled in the 8-inch deep straw on the floor.

The roosting closet has been closely observed and has never been damp or its odors offensive when opened in the mornings. There was very little freezing in the closets in the coldest weather. The birds seemed to enjoy coming out of the warm sleeping closet down into the cold straw, which was always dry, because the whole house was open to the outside air and sun every day. There were no shut-off corners of floor or closet that were damp.

This building was used through five winters with 50 hens in it. The birds laid as well as the others in the large warmed house; their combs were red and their plumage bright, and they gave every evidence of perfect health and vigor. While they were on the roosts they were warm. They came down to their breakfasts and spent the day in the open air. Such treatment gives vigor and snap to the human being, and it seems to work equally well with the hen.

This house was given the name of the "pioneer" house.

CURTAIN-FRONT HOUSES.

The result of the use of the "pioneer" house indicated that this was a correct system of treating and housing hens, and it was decided to build several houses on the same plan and join them together under one roof as one house.

A curtain-front house 12 feet wide by 150 feet long, known as house No. 2, was erected in 1903. The back wall is 5 feet 6 inches high from floor to top of plate inside, and the front wall is 6 feet 8 inches high. The roof is of unequal span, the ridge being 4 feet in from the front wall; and the height of the ridge above the floor is 9 feet. The sills are 4 by 6 inches in size and rest on a rough stone wall laid on the surface of the ground. A central sill gives support to the floor, which at times is quite heavily loaded with sand. The floor timbers are 2 by 8 inches in size and are placed 2 feet apart; the floor is of two thicknesses of hemlock boards. All the rest of the frame is of 2 by 4 inch stuff. The building is boarded, papered, and shingled on roof and walls. The rear wall and 4 feet of the lower part of the rear roof are ceiled on the inside of the studding and plates, and the space between inner and outer walls is packed very hard with dry sawdust. In order to make the sawdust packing continuous between the wall and roof, the wall ceiling is carried up to within 6 inches of the plate; then follows up inclining pieces of studding to the rafters, the short pieces of studding being nailed to the studs and rafters. By this arrangement there are no slack places

around the plate to admit cold air. The end walls are packed in the same way. The house is divided by close-board partitions into seven 20-foot sections; one 10-foot section is reserved at the lower end for a feed-storage room.

Each of the 20-foot sections has two 12-light outside windows screwed onto the front, and the space between the windows (which is 8 feet long) for a distance of 3 feet down from the plate is covered during rough winter storms and cold nights by a light frame covered with 10-ounce duck, oiled and closely tacked on. This door, or curtain, is hinged at the top and swings in and up to the roof when open.

In the front of each section is a door 2 feet 6 inches wide. The roost platform is at the back of each room and extends the whole 20 feet. The platform is 3 feet 6 inches wide and 3 feet above the floor. The roosts are of 2 by 3 inch stuff placed on edge and are 10 inches above the platform. The back one is 11 inches out from the wall, and the space between the two roosts is 16 inches, leaving 15 inches between the front roost and the duck curtain, which is sufficient to prevent the curtain being soiled by the birds on the roost. The two curtains in front of the roost are similar to the one in the front of the house, except that they are not oiled. They are each 10 feet long by 30 inches wide, hinged at the top, and open into the room and fasten up when not in use. Great care was exercised in constructing the roosting closets to have them as nearly air-tight as possible, except as air might come in through the cloth curtain.

Single pulleys are hung at the rafters, and by means of a rope fastened to the lower edge of the curtain frames it is easily raised or lowered and kept in place.

Six trap nests are placed at one end of each room and four at the other. They are put near the front so that the light may be good for reading and recording the numbers on the leg bands of the birds. Several shelves are put on the walls 18 inches above the floor for shell, grit, bone, etc. The doors which open from one room to another throughout the building are frames covered with 10-ounce duck, so as to make them light, and are hung with double-action spring hinges. The advantages of having all doors push from the person passing through are very great; otherwise they would hinder the passage of the attendant with his baskets and pails. Strips of old rubber belting are nailed around the studs which the doors rub against as they swing to, so as just to catch and hold them from being opened by the wind. Tight board partitions are used between the pens instead of wire, so as to prevent drafts. An outside platform 3 feet wide extends across both ends and the entire front of the building.

This house accommodates 350 hens—50 in each 20-foot section—is well made of good material, and should prove to be durable. A

rougher building, with plain instead of trap nests, and with the roof and walls covered with some of the prepared materials instead of shingles, could be built for less money, and would probably furnish as comfortable quarters for the birds. The interior of one section of this house is shown in figure 4.

Curtain-front house No. 3 was constructed in 1904. It is 16 feet wide by 120 feet long, and is of the same style as No. 2, except that it is wider. There are four pens in the building, each 16 feet wide by 30 feet long. Two of the pens are arranged for 100 hens each, and two for 150 each. For the 150 hens three roosts instead of two are required.

The cloth-covered fronts of the closets where 100 and 150 hens roost are of the same size, and it became evident early in the first winter

FIG. 4.—Interior of curtain-front poultry house No. 2.

that the supply of fresh air to the largest flock was not sufficient. It was not practicable to increase materially the cloth surface and allow more air to filter in, so three openings were made in the upper part of the curtain frame, through which better ventilation could be secured. The openings are 6 inches wide by 30 inches long and are provided with wooden shutters. These are kept wide open into the outer room during mild nights, but when high winds prevail and the temperature falls to 10 or more degrees below zero the openings are half closed.

The walls of the elevated closet are packed with sawdust 4 inches in thickness, and the curtains fit very closely, leaving only small cracks. The 10-ounce duck of which the curtains are made is not oiled. The supply of fresh air is mostly admitted through the cloth, while the breathed warmer air passes off through the openings above. By this

arrangement the birds are not in drafts or currents of air. Where three roosts are arranged abreast, instead of two, the openings are absolutely essential, and for smaller flocks they are convenient during the mild nights, especially toward spring.

The latest form of curtain-front house.—During the summer of 1905 the management of a commercial poultry plant in Orono built a curtain-front house to accommodate 2,000 laying hens. This was built in accordance with unpublished plans prepared by the Maine Experiment Station. The description is here given, as it represents the latest development of this style of house. The appearance of the house as a whole is shown in figure 5.

The house is 20 feet wide by 400 feet long, and is divided into 20 sections, each being 20 feet square. It is on the same general plan as houses Nos. 2 and 3 just described, but house No. 2 is 12 feet wide, house No. 3, 16 feet wide, and this one 20 feet wide. The widths have been increased in the last two houses, as experience has shown the advisability of it. At first it was thought the houses should be nar-

FIG. 5.—The latest curtain-front poultry house.

row so they might dry out readily, but the 20-foot house dries out satisfactorily, as the opening in the front is placed high up so that the sun shines in on the floor to the back in the shortest winter days.

The economy in the cost of the wide house over the narrow ones, when space is considered, is evident. The front and back walls in the narrow house cost about as much per linear foot as those in the wide house, and the greatly increased floor space is secured by building in a strip of floor and roof running lengthwise of the building. The carrying capacity of a house 20 feet wide is 66 per cent greater than that of a house 12 feet wide, and it is secured by merely building additional floor and roof. The walls, doors, and windows remain the same as in the narrow house, except that the front wall is made a little higher. Three sills, which are 6 inches square, run lengthwise of the house, the central one supporting the floor timbers in the middle. They rest on a rough stone wall, high enough from the ground for dogs to go under the building to look after rats and skunks that might incline to make their homes there. The stone wall rests on the surface of the ground,

and there are openings in it like cellar windows, every 20 feet, to allow the air to draw through and keep the basement dry during the summer. The floor timbers are 2 by 8 inches in size and rest wholly on top of the sills. All wall studs rest on the sills; the front ones are 8 feet long, and the back ones 6 feet 6 inches long. The two sides of the roof are unequal in width, the ridge being 8 feet from the front wall. The height of the ridge from the sill to the extreme top is 12 feet 6 inches. All studding is 2 by 4 inches in size and the rafters are 2 by 5 inches. The building is boarded with 1-inch boards, and is papered and shingled with good cedar shingles on walls and roof. The floor is of two thicknesses of hemlock boards which break joints in the laying.

The building is divided by tight board partitions into twenty sections, each section being 20 feet long. All of the sections are alike in construction and arrangement. The front side of each section has two storm windows of twelve lights of 10 by 12 inch glass. These windows are screwed on upright and 2 feet 8 inches from each end of the room; they are 3 feet above the floor. The distance between the windows is 8 feet 10 inches, and the top part of it to a depth of 3 feet 6 inches from the plate is not boarded but is left open to be covered by the cloth curtain when necessary. This leaves a tight wall 3 feet 10 inches high extending from the bottom of the opening down to the floor, which prevents the wind from blowing directly on the birds when they are on the floor. A door is made in this part of the front wall for the attendant to pass through when the curtain is open. A door 16 inches high by 18 inches wide is placed close to the floor under one of the windows for the birds to pass through to the yards in front. A similar door is in the center of the back wall to admit them to the rear yard when it is used.

A light frame made of 1 by 3 inch pine strips and 1 by 6 inch crossties is covered with 10-ounce white duck and hinged at the top of the front opening, which it covers when closed down. This curtain is easily turned up into the room, where it is caught and held by swinging hooks until released.

The roost platform is made tight and extends along the whole length of the room against the back wall. It is 4 feet 10 inches wide and 3 feet above the floor, being high enough for a person to get under it comfortably when necessary to catch or handle the birds. There are three roosts framed together in two 10-foot sections. The tops of the roosts are 1 foot above the platform and hinged to the back wall, so they may be turned up out of the way when the platform is being cleaned. The back roost is 12 inches from the wall, and the spaces between the next two are 16 inches. They are made of 2 by 3 inch spruce lumber placed on edge with the upper corners rounded off.

The roosting closet is shut off from the rest of the room by curtains similar to the one described above. For convenience in handling there are two of these curtains, each 10 feet long. They are 3 feet wide and are hinged at the top so as to be turned out and hooked up. The space above this curtain is ceiled and in it are two openings each 3 feet long and 6 inches wide for ventilating the roosting closet when necessary. In every compartment there is a door placed 5 inches out from the edge of the roost platform. These doors are 3 feet wide and 7 feet high, divided in the middle lengthwise, and each half is hung with double-acting spring hinges, allowing it to swing open both ways and close.

Ten nests are placed in two tiers against the partition in each end of the room. They are of ordinary form, each nesting space being 1 foot wide, 1 foot high, and 1 foot long, with the entrances near the partition, away from the light, and with hinged covers in front for the removal of the eggs. Each section of 5 nests can be taken out without disturbing anything else, cleaned, and returned. In constructing the house it was designed to use these nests only during the first year. The framework where they rest was arranged for the use of trap nests, which were installed in October, 1906.

Troughs similar to those described on page 18 are used for feeding dry mash, shell, bone, grit, and charcoal.

Two lines of 4 by 4 inch spruce are arranged as an elevated track above the doors. The track extends the entire length of the building, and being faced with narrow steel bands on top, a suspended car is readily pushed along, even when heavily loaded. The car platform is 2 by 8 feet in size, and is elevated a foot above the floor. All feed and water are carried through the building on this car. Ten iron baskets, into which the accumulations on the roost platforms are cleaned every morning, are put on the car, and collections are made as the car passes on through the pens to the far end of the building, 400 feet away, where the roost cleanings are dumped into the manure shed. As the car is pushed along a guard at the front end comes in contact with the doors and pushes them open, and they remain open until the car has passed on, when the spring hinges force them to close again. This car is a great saver of labor, as it does away with nearly all carrying by the workmen. It has enabled one man to take good care of the 2,000 hens from November to March, except on Saturdays, when the litter was removed and renewed by other men.

At one end of the building there is a temporary feed and water house, also used for dish washing and scalding, where the car remains when not in use.

There is a walk outside of the building, extending along its entire front. It is 4 feet wide, made of 2-inch plank, and is elevated 2 feet

above the floor of the building, which allows the doors below it, through which the birds pass to the front yards, to be opened and closed without interference. The door which opens out of each room

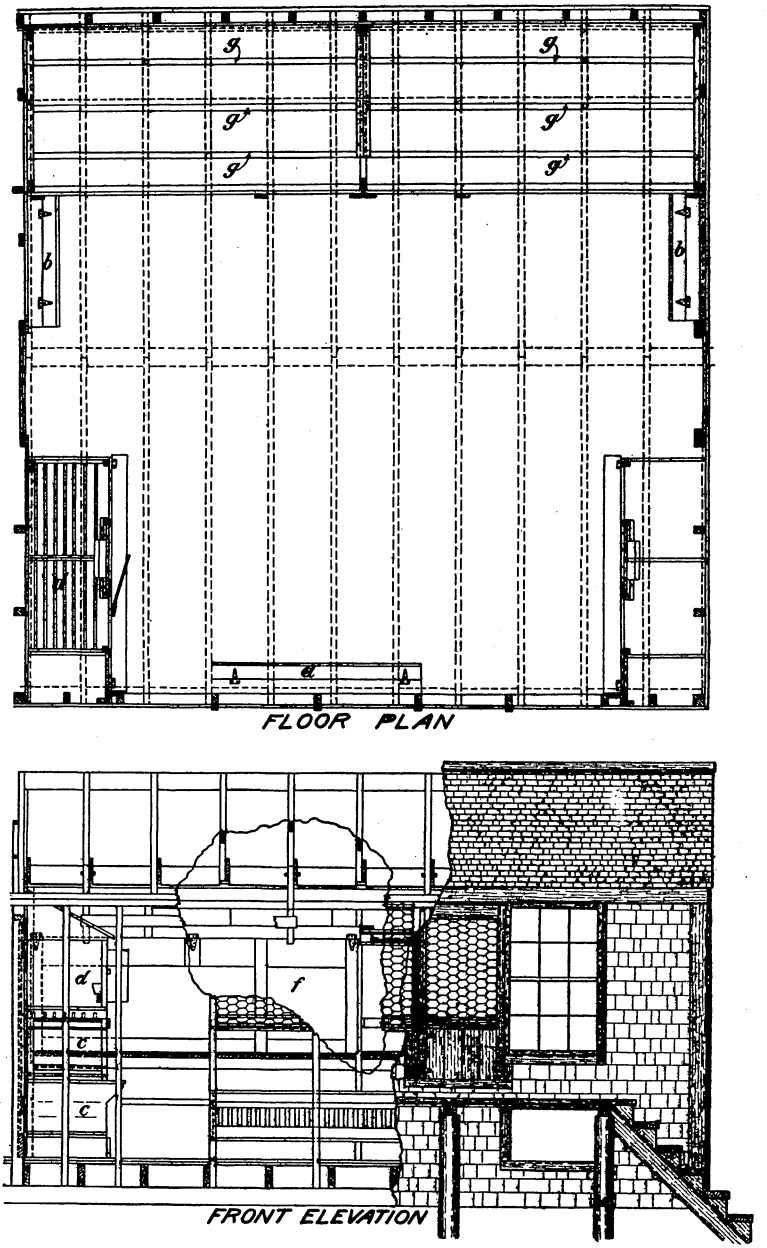

FIG. 6.—Floor plan and front elevation of section of latest curtain-front poultry house. *a*, Feed trough for dry mash; *b*, feed trough for grit, bone, etc.; *c*, trap nest; *d*, coop for broody hens; *e*, front curtain; *f*, roosting closet curtain; *g*, roost bars; *h*, small closet in which eggs taken from nest are placed.

through the curtain section is above the outside walk and necessitates stepping up or down when passing through, which is not a very serious objection, as the door is used but little in the daily work, but mostly in the weekly cleaning out and renewing of the floor litter. A guard of wire poultry netting 1 foot wide along the outside of the walk prevents the birds from flying from the yards up to the walk. The advantage of the elevated walk over one on a level with the sill of the building is that it is unobstructed by gates, which, were the low walk used, would be necessary to prevent the birds passing from one yard to another.

Detailed working drawings and specifications for one section or unit of this curtain-front house follow. From these data anyone can

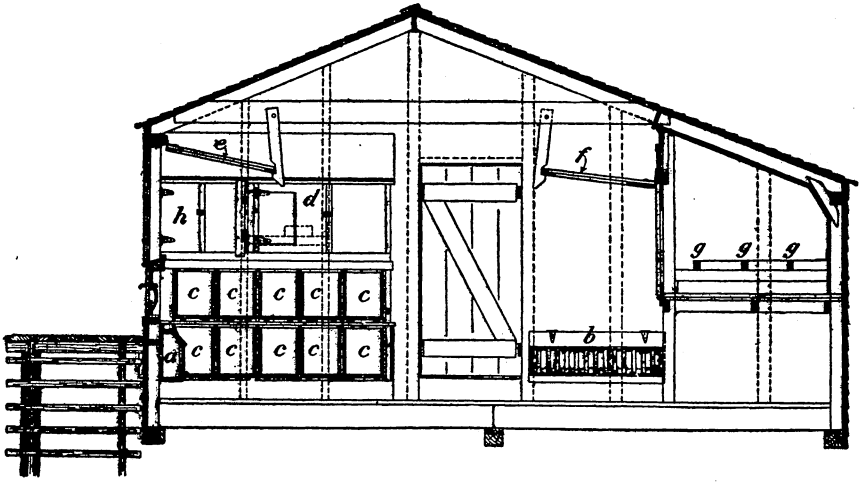

FIG. 7.—End elevation (inside) of latest curtain-front poultry house. (For key to letters, see fig. 6.)

figure what will be the cost of building one of these houses of any desired length at the prices of building material current in his locality.

Material needed for a unit of curtain-front house:

LUMBER.

(Spruce is specified simply because that is the material actually used in the building described. Any other equally strong lumber may be used. Amounts are given in board feet unless otherwise specified.)

The following estimates do not allow for waste in cutting.

8 cedar posts, 6 feet long, 6-inch butts.

350 feet 2 by 4 inch spruce for studs, door, window, and coop frames.

650 feet 2 by 8 inch plank for floor joists, outside walk, etc.

180 feet 6 by 6 inch spruce for sills.

26 feet 4 by 4 inch spruce for corner studs and wall stringers.

40 feet 2 by 3 inch spruce for roosts, etc.

215 feet 2 by 5 inch spruce for rafters.

39 feet 2 by 9 inch spruce for steps.

12 feet 2 by 6 inch spruce for step frames.

110 feet 1 by 8 inch boards, spruce, for braces for rafters.
38 feet 1 by 9 inch boards, spruce, for doors.
10½ feet per door 6-inch boards, spruce, for door braces.
2,300 feet boards, spruce or hemlock, for outside boarding, walls, floor, roof, etc.
100 feet boards, spruce, for roost frames.
40 linear feet 2 by 2 inch spruce planed to 1¾ by 1¾ inches.
6 feet 2 by ¾ inch spruce.
55 feet spruce boards for feed and grit troughs.
50 feet pine for curtain frames.
20 laths.
6,000 cedar shingles.

HARDWARE.

1 pair double-acting spring hinges with screws.
1 pair 6-inch heavy T hinges with screws.
7 pairs 5-inch light T hinges with screws.
4 pairs 3-inch light T hinges with screws.
2 pairs 2 by 2 inch butts with screws.
5 pairs 3 by 3 inch butts with screws.
2 dozen No. 10 screws 2 inches long.
20 pounds 3-penny shingle nails.
75 pounds 8-penny common nails.
25 pounds 10-penny common nails.
10 pounds 20-penny common nails.
2 pounds 3-penny clinch nails.
1 pound ¾-inch staples.
2 thumb latches complete with screws.

MISCELLANEOUS.

2 storm windows, 12 lights, 10 by 12 inch glass.
6 squares building paper.
10 feet 42-inch poultry netting.
3 yards 42-inch, 10-ounce duck.
7 yards 30-inch, 10-ounce duck.

Advantages of curtain-front houses.—The "pioneer" house was in use for five years with 50 pullets in it each year; the No. 2 house has been in use five years with 300 pullets each year, the No. 3 house four years, and the house last described three years. Besides these four houses, the Maine station has had the use of another house of the open-front style of construction for six years with about 200 1-year-old breeding hens in it each year.

Maine is subject to long spells of severe cold weather, with the temperature considerably below zero at night, and about zero during the day, and with a good deal of high wind. During such rough weather the bedding on the floor has kept comparatively dry; and the voidings on the platform, when the curtains are raised in the mornings, have been but slightly frozen. The yields of eggs during severe weather and immediately following it are rarely below those immediately preceding it. It should be borne in mind that had the weather been mild all that time the hens probably would have increased in pro-

duction rather than remained stationary. They are doubtless affected by the severe weather, but not seriously, as they uniformly begin to increase in production very soon after the weather becomes normal for midwinter.

These curtain-front houses have all proved eminently satisfactory. Not a case of colds or snuffles has developed from sleeping in the warm elevated closets, with their cloth fronts, and then going directly down into the cold room, onto the dry straw, and spending the day in the open air. The egg yields per bird have been as good in these houses as in warmed ones. The purpose of having rooms and flocks of different sizes was to compare the welfare and egg yields of the birds under the different conditions.

THE YARDS.

The yards to most poultry houses are at the south, or on the sheltered sides of the buildings, to afford protection during the late fall and early spring, when cold winds are common. The warmed house had yards on both north and south sides, with convenient gates. The south yards were used until the cold winds were over in spring, when the hens were allowed to go to the north yards, which were well set in grass sod. With the curtain-front houses the yards need be on the north side only. The birds are kept in the building until the weather is suitable for opening the small doors in the rear wall. The necessity for getting them out of the open-front house, where they are really subject to most of the out-of-door conditions during the daytime, is not so great as when they are confined in closed houses with walls and glass windows. The clear, open fronts of the curtain-front houses allow teams to pass close to the open door of the pens for cleaning out worn material and delivering new bedding, and also allow attendants to enter and leave all pens from the outside walk and reach the feed room without passing through intervening pens.

FEEDING THE HENS.

For about twenty-five years the same family of Barred Plymouth Rocks has been carried at the University of Maine, and one way has been learned to feed and handle them to secure eggs and to avoid the losses from overfatness, which are so common to mature hens of that breed. It is not claimed or thought that the methods of feeding here given are ideal; other methods may be as good or even better. These methods have, however, given good results at the Maine station. While it is true that only the full-fed hen can lay to the limit of her capacity, it is equally true that full feeding of the Plymouth Rocks, unless correctly done, results disastrously.

Years ago the "morning mash," which was regarded as necessary to "warm up the cold hen," so she could lay that day, was given up.

The method of feeding now employed is in detail as follows: Early in the morning for each 100 hens 4 quarts of whole corn is scattered on the litter, which is 6 to 8 inches deep on the floor. This is not mixed into the litter, for the straw is dry and light, and enough of the grain is hidden so the birds commence scratching for it almost immediately. At 10 o'clock they are fed in the same way 2 quarts of wheat and 2 quarts of oats. This is all of the regular feeding that is done.

The use of corn and corn meal as major parts of the feed of hens kept for egg production has been very generally condemned by poultrymen and farmers, until it is now used only as a very minor part of the ration for the fear that its use will cause overfatness and interfere with egg making. When used more freely and made a prominent factor in the ration it has been thought best to have the kernels broken, so that in hunting and scratching for the small pieces the birds might get the exercise needed to keep themselves in health and vigor. It was reasoned that even a small quantity of whole corn could be readily seen and picked up from the straw litter with little exertion, and that the vices of luxury and idleness would follow. In order to test this view an experiment was carried out at the station in the winter of 1906–7 in which whole corn was substituted for cracked corn in the ration of 500 laying pullets. A control lot of 500 received cracked corn. All other conditions affecting the two lots were kept as nearly identical as possible. The result of the experiment was that there was no appreciable difference in regard to either egg production, health, or general well-being between the two flocks of birds.

Besides the dry whole grain a dry mash is kept always before the birds. Along one side of the room is the feed trough with its slatted front, and in it is kept a supply of dry meals mixed together. This dry-meal mixture or mash has the following composition:

	Parts by weight.
Wheat bran	2
Corn meal	1
Middlings	1
Gluten meal or brewers' grains	1
Linseed meal	1
Beef scrap	1

These materials are spread on the floor in layers one above another and shoveled together until thoroughly mixed, then kept in stock for supplying the trough. The trough is never allowed to remain empty.

The dry-meal mixture is constantly within reach of all of the birds, and they help themselves at will.

Oyster shell, dry cracked bone, grit, and charcoal are kept in slatted troughs, and are accessible at all times. A moderate supply of mangolds and plenty of clean water is furnished. About 5 pounds of clover hay cut into ½-inch lengths is fed dry daily to each 100 birds in winter. When the wheat, oats, and cracked corn are given, the birds are always ready and anxious for them, and they scratch in the litter for the very last kernel before going to the trough where an abundance of feed is in store.

It is very evident that the hens like the broken and whole grains better than the mixture of the fine, dry materials; yet they by no means dislike the latter, for they help themselves to it, a mouthful or two at a time, whenever they seem to need it, and never go to bed with empty crops, so far as noted. They apparently do not like it well enough to gorge themselves with it, and sit down, loaf, get overfat, and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

Some of the advantages of this method of feeding are that the mash is put in the troughs at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing that always occurs at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is common when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

For green feed during winter and spring mangolds are used. They are liked by the birds, and when properly harvested and cared for remain crisp and sound until late spring. They are fed whole, by sticking them onto projecting nails about a foot and a half above the floor. Care must be exercised in feeding them, as they are a laxative when used too freely. On the average about a peck per day to 100 hens can be safely used. They would eat a much greater quantity if they could get it.

The average amounts of the materials eaten by each hen during the last year are about as follows:

	Pounds.
Grain and the meal mixture	90. 0
Oyster shell	4. 0
Dry cracked bone	2. 4
Grit	2. 0
Charcoal	2. 4
Clover	10. 0

A POULTRY-HOUSE DISINFECTANT.

There can be no doubt that one absolutely necessary supply about every well-conducted poultry plant must be some sort of disinfecting solution. Furthermore, such a disinfectant ought to fulfill satisfactorily several requirements. In the first place, it must be inexpensive. Further, it must be powerful and certain in its action even in dilute solutions. Finally, it must be of such a character as not to injure the birds if it, by accident or design, comes in contact with them. There are a great many commercial disinfectants on the market. Some of the most successful and widely used of these have either a phenol (carbolic acid) or a cresol base. Many of these preparations are excellent and their excellence is attested by their very wide popularity among poultrymen. There is one objection, however, to all of them; that is, that they are relatively expensive. The farmer or poultryman who uses them pays a good round price for the manufacture of something which he could manufacture himself, the only cost in that event being the cost for the raw materials.

The station has carried on a number of experiments with disinfectants to find a material well suited to the needs of the poultryman which should at the same time be cheap and easy to manufacture. As a result of these experiments the conclusion has been reached that, on the whole, cresol is an excellent substance for poultry-house disinfection. Experiments of the Department of Agriculture [a] have shown that cresol is one of the most powerful germicides and disinfectants known. The experience of the station shows that in addition to the germicidal value of a cresol solution it has a very considerable value as a poultry insecticide. It has even been used with satisfactory results to rid hens of lice by direct spraying of the birds. A very small application in spray was found to rid a bird of lice without harmful effect to the bird itself.[b] Furthermore, in the experience of the station it is, when applied as a spray, very effective in ridding the houses, nests, etc., of lice.

Cresol may be stirred up directly with water and used as a spray. Since cresol is only slightly soluble in water it is better to make use of the "compound solution of cresol" (liquor cresolis compositus) of the United States Pharmacopeia.

Liquor cresolis compositus, or, as it may for convenience be called, cresol soap, may be easily manufactured by any poultryman. The

[a] McBryde, C. N. The Germicidal Value of Liquor Cresolis Compositus (U. S. P.). Bureau of Animal Industry Bulletin 100, pp. 1–24, 1907.

[b] We do not recommend this method of ridding birds of lice, because of the danger that the bird will take cold as a result of the wetting. This experiment was performed simply to test the value of the cresol solution as an insecticide under the most unfavorable conditions for its action.

only requisite is a careful attention to the details in the process and a rigid following of the instructions given below. In order to make clear the reasons for the method of manufacture which will be outlined it may be well to give some account of the nature of the substance itself. The active base or cresol soap disinfecting solution is commercial cresol. This is a thick, sirupy fluid varying in color in different lots from a nearly colorless fluid to a dark brown. It does not mix readily with water, and therefore in order to make satisfactorily a dilute solution it is necessary first to incorporate the cresol with some substance which will mix with water and will carry the cresol over into the mixture. The commercial cresol as it is obtained is a corrosive substance, being in this respect not unlike carbolic acid. It should, of course, be handled with great care, and the pure cresol should not be allowed to come in contact with the skin. If it does so accidentally the spot should be immediately washed off with plenty of clean water. The price of commercial cresol varies with the drug market. It can be obtained through any druggist. On the day that this is written the quotation on cresol in the New York market is 24 cents a pound. In purchasing this article one should order simply "commercial cresol."

The solution or soap referred to is made as follows: Measure out 4 quarts of raw linseed oil in a 4 or 5 gallon stone crock; then weigh out in a dish 1¾ pounds of commercial potassium hydroxid or caustic potash, which may be obtained from any druggist at a cost of from 10 to 15 cents a pound. Dissolve this caustic potash in one pint of water; let it stand for at least three hours until the potash is completely dissolved and the solution is cold; then add the cold potash solution very slowly to the linseed oil, stirring constantly. Not less than five minutes should be taken for the adding of this solution of potash to the oil. For five hours after mixing the oil and potash mixture (soap) should be stirred thoroughly about once every hour and then left standing for ten or twelve hours. By the expiration of that time saponification should be complete. The soap should then be stirred and broken up into small pieces and 5¼ quarts of commercial cresol should be added. The soap will slowly dissolve in this cresol. It may take two days for complete solution to be effected. The length of time taken in dissolving will depend on the condition of the soap, which in turn varies with different lots of linseed oil. When the soap is all dissolved, the solution, which is liquor cresolis compositus or cresol soap, is then ready to use. This cresol soap will mix in any proportion with water and yield a clear solution.

As has been said, cresol soap is an extremely powerful disinfectant. In the station poultry plant for general purposes of disinfecting the houses, brooders, brooder houses, incubators, nests, and other wood-

work it is used in a 2 per cent solution with water. Three or four tablespoonfuls of the cresol soap to each gallon of water will make a satisfactory solution. This solution may be applied through any kind of spray pump or with a brush. Being a clear watery fluid, it can be used in any spray pump without difficulty. For disinfecting brooders or incubators which there is reason to believe have been particularly liable to infection with the germs of white diarrhea or other diseases the cresol may be used in double the strength given above and applied with a scrub brush in addition to the spray.

The first consideration in choosing a disinfectant must be its effectiveness. It is a poor sort of economy to use a disinfectant which costs little and will kill few or no germs. Taking into account its effectiveness in dilute solutions, liquor cresolis compositus is believed to be one of the best and cheapest germicides and disinfectants available. The station is using it altogether in its own work and feels justified in recommending it to poultrymen.

TRAP NESTS.

In all the experimental work with laying hens at the Maine station use is made of trap nests. During the past year a new type of trap nest [a] has been devised which is proving extremely satisfactory. The features in which this nest is superior to the type formerly used at the station are (1) certainty and precision of operation; (2) greater simplicity of construction, with less tendency to get out of order and work badly; (3) saving of labor in resetting the nest after use.

The nest is a box-like structure, without front, end, or cover, 28 inches long, 13 inches wide, and 16 inches deep, inside measure. A division board with a circular opening 7½ inches in diameter is placed across the box 12 inches from the rear end and 15 inches from the front end. Instead of having the partition between the two parts of the nest made with a circular hole, it is possible to have simply a straight board partition extending up 6 inches from the bottom, as shown in figure 8. The rear section is the nest proper.

The front portion of the nest has no fixed bottom. Instead there is a movable bottom or treadle which is hinged at the back end (fig. 8). To this treadle is hinged the door of the nest. The treadle

[a] While this bulletin was going through the press the writer was informed that a trap nest embodying certain features similar to those in the nest here described was in use at the Utah Agricultural Experiment Station. An examination of the bulletins of that station fails to disclose a description of such a nest. The nest here described was independently devised at the Maine station. Inasmuch as no description of the principle of trap-nest construction here made use of has hitherto been published, it is impossible to make any further acknowledgment of priority in the matter than is contained in the statement here made.

is made of ½-inch pine stuff, with 1½-inch hard-wood cleats at each end (figs. 9 and 10) to hold the screws which fasten the hinges. It is 12 inches wide and 12¼ inches long. Across its upper face just behind the hinges holding the door is nailed a pine strip 4 inches wide, beveled on both sides, as shown in figures 9 and 10. The door of the nest is not made solid, but is an open frame (figs. 8 and 10), to the inner side of which is fastened (with staples) a rectangular piece of ⅛-inch mesh galvanized screening (dimensions 8 by 9 inches). The sides of the door are strips of ¾-inch beech stuff 12 inches long and 1½ inches wide, halved at the ends to join to the top and bottom of the door. The top of the door is a strip of hard wood 13 inches long and 1½ inches wide, halved in 2¾ inches from each end. The projecting ends of this top strip serve as stops for the door when it closes (fig. 8). The bottom of the door is a hard-wood strip 10¼ inches by 4 inches. The side strips are fitted into the ends of this bottom strip in such way as to project slightly (about $\frac{1}{32}$ inch) above the front surface of that strip, for a reason which will be apparent.

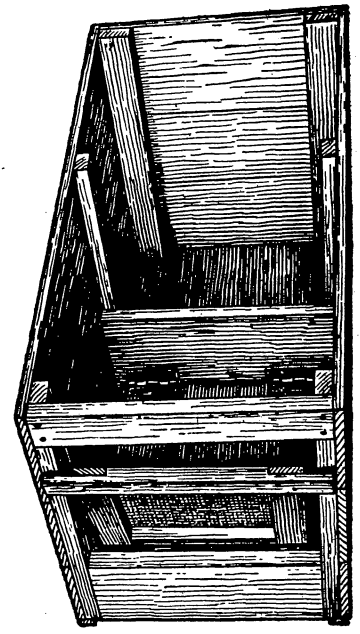

FIG. 8.—Trap nest closed. View from above.

When the nest is open the door extends horizontally in front, as shown in figure 9. In this position the side strips of the door rest on a strip of beech 1½ inches wide, beveled on the inner corner, which extends across the front of the nest. This beech strip is nailed to the top of a board 4 inches wide, which forms the front of the nest box proper. To the bottom of this is nailed a strip 2 inches wide, into which are set two 4-inch spikes from which the heads have been cut (compare fig. 9). The treadle rests on these spikes when the nest is closed. The hinges used in fastening the treadle and door are narrow 3-inch galvanized butts with brass pins, made to work very easily. It is necessary to use hinges which will not rust.

The manner in which the nest operates will be clear from an examination of figures 9 and 10, which show a sample nest with one side removed to show the inside. A hen about to lay steps up on the door and walks in toward the dark back of the nest. When she passes the point where the door is hinged to the treadle her weight on the treadle causes it to drop. This at the same time pulls the door up behind her,

as shown in figure 10. It is then impossible for the hen to get out of the nest till the attendant lifts door and treadle and resets it. It will be seen that the nest is extremely simple. It has no locks or triggers to get out of order. Yet by proper balancing of door and treadle it can be so delicately adjusted that a weight of less than half a pound on the treadle will spring the trap. All bearing surfaces are made of beech because of the well-known property of this wood to take on a highly polished surface with wear. The nests in use at the Maine station have the doors of hard wood, in order to get greater durability. Where trap nests are constantly in use, flimsy construction is not economical in the long run. For temporary use the nest door could be constructed of soft wood.

The trap nests are not made with covers because they are used in tiers and slide in and out like drawers. They can be carried away for cleaning when necessary. Four nests in a pen accommodate 20 hens

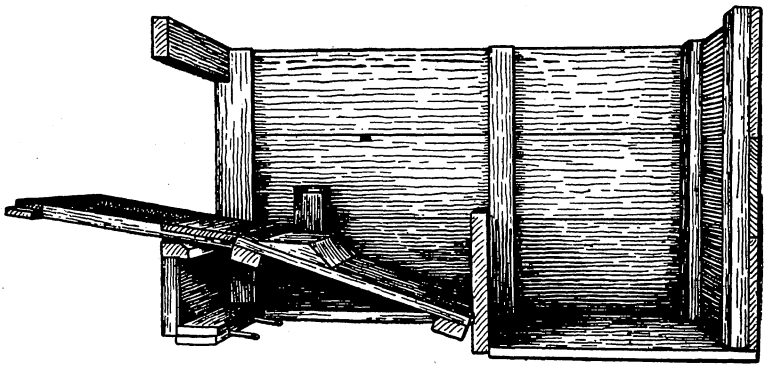

FIG. 9.—Trap nest open. One side removed to show method of operation.

by the attendant going through the pens once an hour, or a little oftener, during that part of the day when the hens are busiest. Earlier and later in the day his visits are not so frequent. The hens must all have leg bands in order to identify them; a number of different kinds are on the market. The double box with the nest in the rear is necessary. When a hen has laid an egg and desires to leave the nest, she steps out into the front space and remains there until she is released. With only one section she would be likely to crush her egg by stepping upon it, and thus learn the pernicious habit of egg eating.

To remove a hen, the nest is pulled part way out, and as it has no cover she is readily caught, the number on her leg band is noted and the proper entry made on the record sheet. After having been taken off a few times the hens do not object to being handled, most of them remaining quiet, apparently expecting to be picked up.

Before commencing the use of trap nests it was thought that some hens might be irritated by the trapping operation and object to the noise incident to it, but such does not seem to be the case. Trap nests have been used at the Maine station for Leghorns, Brahmas, Wyandottes, and Plymouth Rocks.

The amount of time required in caring for the trap nests can only be estimated, since the attendant's time is divided with other duties. The time varies from one day to another and with the number of nests

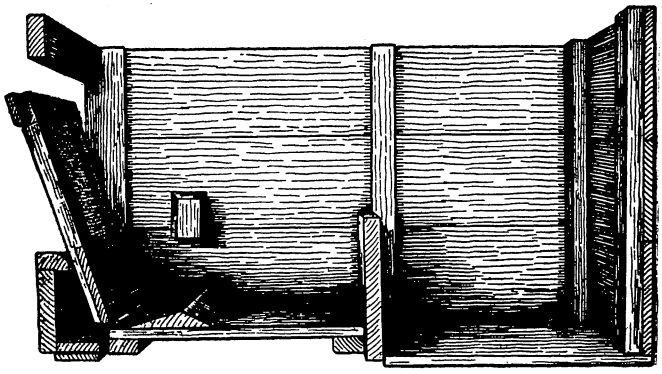

FIG. 10.—Trap nest closed. One side removed to show method of operation.

in use. By noting the total time used each day in caring for the nests when the hens were laying most heavily, it has been estimated that one active person devoting his entire time to trap nests could take care of 400 to 500 nests used by 2,000 to 2,500 hens. When commencing the year's work he would need assistance in banding the birds, but after that was done he could care for the nests without assistance until midsummer, when the egg yields would probably be diminished and a part of his time could be spared for other duties.

O